

Directions and Questions for Final Exam

Bring **two** bluebooks available in the university bookstore with **nothing** written in or on them (not even your name). These may be redistributed at the time of the exam.

The exam will consist of the two parts, for which the instructions are as follows:

Part A. Answer each of the following six questions in two to three sentences each (do not go on at length—you will *not* receive extra credit for going beyond a basic answer). Each question is worth up to 5 points (30 points total).

The actual questions will be drawn from those listed below:

1. What are the central components of a mechanistic explanation?
2. What sorts of phenomena did Descartes argue could not be explained mechanistically?
3. Why is it that some cells in the hippocampus are referred to as “place cells”?
4. What activity has been observed in place cells when rodents are in the start area but temporarily held back from running a maze they have run previously?
5. What is it to simulate a mechanism mentally?
6. What is meant by an “attractor” in a dynamical system?
7. How can computational models be used to recompose a mechanism?
8. What is meant by a connectome?
9. In terms of characteristic path length and the clustering coefficient, what constitutes a small world?
10. Why is the loss of a node in a network with especially high degree typically extremely serious?
11. What is the question to be answered at Marr’s computational level?
12. On Bickle’s account of ruthless reduction, of what use is the study of behavior?
13. How far down should researchers go to explain psychological phenomena on Bickle’s account of ruthless reduction?
14. What is a fundamental difference between ruthless reduction and mechanistic reduction?
15. According to those who treat some neural processes as representations, what is required for a neural process to be a representation?
16. What does Egan mean in calling a characterization of a computational process in terms of representational content a gloss?
17. Why does Akers deny that thermoreceptors represent temperature?
18. What does Akers mean in calling our sensory systems narcissistic?
19. Why does Akers think narcissistic sensory systems are evolutionarily sensible?
20. How does Chemero understand the relation between organisms and their environments that makes it unnecessary to invoke representations?
21. What is an artificial neural network?
22. How do researchers train artificial neural networks?
23. What sort of evidence is used to argue that perception is influenced “top-down”?
24. What does the predictive coding hypothesis claim?
25. How does heterarchy differ from hierarchy?
26. What is meant by a kludge?

Parts B. Address the following two questions each in an essay (35 points each).

On the actual exam, I will pick two of the following questions. Write as clear and detailed an essay as you can in the time allotted.

1. Suppose a researcher develops an equation that describes how variables describing an organism change as it interacts with its environment but does not include any variables describing components of the brain. The equation is sufficient to predict with reasonable accuracy how the organism will behave. Does the equation suffice to *explain* the organism's behavior? Address why some neuroscientists think one has to go into the brain to explain behavior. If a dynamic theorist (think Chemero) were convinced it was necessary to consider activity in the brain, how would he/she likely include it in his or her account? How would the dynamicist's account of brain contributions differ from a mechanistically inclined neuroscientist?
2. Mechanists often speak of recomposing a mechanism. Explain what this involves (it may help to use an example discussed in this course) and why it is important to the project of developing a mechanistic explanation. What are some ways a researcher might actually go about recomposing a mechanism? What might be learned if an attempt at recomposition fails to show how that the phenomenon would be produced? Are there new insights that might be gleaned from reconstructing a mechanism?
3. Some researchers have thought it would be informative to study the brains of especially successful (or otherwise exceptional or distinctive) people after they have died. Imagine that a research team develops a complete structural connectome at the level of individual neurons, their dendrites and axons, of such a human being. What might researchers learn, either about the individual or about people in general, from the resulting connectome? Be sure to discuss some of the ways researchers have analyzed networks to explain how complex systems behave as well as limitations as to what can be learned from a structural network.
4. A mechanist (you can use me as an example) and a dynamicist (e.g., Chemero) meet at a bar and get into a *friendly* discussion. Each tries to engage the other to see how the other could help with their own endeavor. Construct a dialogue between them. Where would each argue that the other would fall short without their contribution? What would each offer as distinctive contributions of their approach? Is there a way they could combine their perspectives in developing explanations of cognitive activities? Are there issues on which they might just have to agree to disagree?
5. Is the characterization of cells in the hippocampus as place cells merely a gloss? Explain what Egan means by a gloss and why she views such attributions of content to representations to be a gloss. Also explain why, on her account, providing such a gloss is important for the scientists. What sort of evidence might researchers advance to show that the organism is using these cells to represent places? Would such evidence provide a compelling rebuttal to Egan?
6. What is it for an agent to exhibit cognitive control (give your own example)? What symptoms would indicate that someone lacked cognitive control? How would the hypothesis of a central executive explain cognitive control and cases where it fails? The claim that the brain is organized heterarchically denies that there is a hierarchy at the top of which a central executive might reside. Could someone who views the brain as organized heterarchically still account for the ability of humans to exert cognitive control? What would be the differences between hierarchical and heterarchical accounts of cognitive control? Would one expect to find different pathologies on the two accounts?